

# Pertussis (Whooping Cough)

## Surveillance Protocol

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### Healthcare Provider Responsibilities

1. Manage patients with pertussis and their close contacts in accordance with physician's guideline available at: [http://www.dhhr.wv.gov/oeps/disease/IBD\\_VPD/VPD/Documents/Pertussis\\_Physician\\_FAQ.pdf](http://www.dhhr.wv.gov/oeps/disease/IBD_VPD/VPD/Documents/Pertussis_Physician_FAQ.pdf)
2. Report suspected and confirmed cases of pertussis to your local health department within 24 hours of diagnosis.
3. Complete the provider section (color coded in yellow) of WV Electronic Disease Surveillance System (WVEDDS) Pertussis form: [http://www.dhhr.wv.gov/oeps/disease/IBD\\_VPD/VPD/Documents/pertussis-report.pdf](http://www.dhhr.wv.gov/oeps/disease/IBD_VPD/VPD/Documents/pertussis-report.pdf) and fax it to your local health department or the West Virginia Division of Infectious Disease Epidemiology (DIDE) by phone at 304-558-5358 or in West Virginia 800-423-1271 (24/7/365). Timely reporting enables your local health department to follow up on contacts and interrupt the chain of transmission.
4. Obtain laboratory confirmation (culture and PCR) of suspect cases available free of charge at West Virginia Office of Laboratory Services (OLS) at 304-558-3530, after consulting with your local health department or DIDE. For more information about testing at OLS please visit: <http://www.wvdhhr.org/labservices/labs/micro/index.cfm>.

*Note: The Centers for Disease Control and Prevention (CDC) does not recommend serology testing for diagnosis of pertussis.*

### Laboratory Responsibilities

- 1) Notify provider and infection preventionist of a positive lab reports of pertussis immediately.
- 2) Notify local health department or West Virginia Division of Infectious Disease Epidemiology (DIDE) of a positive report of pertussis within 24 hours of diagnosis. Fax a copy of a laboratory result to DIDE at 304-558-8736.

*Note: The Centers for Disease Control and Prevention (CDC) does not recommend serology testing for diagnosis of pertussis.*

### Public Health Action

1. Employees who will take nasopharyngeal swab on symptomatic persons or who will interview or have face-to-face contact with infectious persons should have one dose of Tdap and wear a surgical mask.
2. Educate the public including, parents and guardians of infants and children, adolescents, adults, healthcare providers and pregnant women about the importance of the vaccination according to the Advisory Committee on Immunization Practices (ACIP) recommendation and about the dangers of whooping cough.

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## Division of Infectious Disease Epidemiology

10.06.2011

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3. Educate healthcare providers and laboratories to report any suspect cases of pertussis to your local health department within 24 hours of diagnosis.
4. Educate providers and laboratories to submit pertussis specimens (nasopharyngeal swabs or aspirate) to the West Virginia Office of Laboratory Services (OLS) for PCR and culture confirmation (free of charge). PCR alone is associated with high rates of false positive results; therefore CDC recommends culture whenever PCR is performed.

*Note: Serologic tests are neither diagnostic nor recommended by CDC.*

5. Upon receiving a report of pertussis:
  - a) Investigate any suspect case of pertussis immediately to identify close contacts and prevent secondary transmission by using the WVEDDS Pertussis form:  
[http://www.dhhr.wv.gov/oeps/disease/IBD\\_VPD/VPD/Documents/pertussis-report.pdf](http://www.dhhr.wv.gov/oeps/disease/IBD_VPD/VPD/Documents/pertussis-report.pdf)  
Check to confirm that the reported case meets the case definition for both clinical and/or laboratory criteria. Obtain accurate and complete information.
  - b) Assure that a nasopharyngeal swab or aspirate is obtained for culture before initiating treatment with recommended antibiotics (see table 1), if not already done.
  - c) Notify your regional epidemiologist and Division of Infectious Disease Epidemiology (DIDE) at 304-558-5358. If subsequent cases occur, continue to notify them.
  - d) Assure the case is isolated for 5 days after beginning of a full course of antimicrobial treatment or until 21 days from onset of cough in those who do not receive antimicrobial therapy.
  - e) Complete any pertussis death case by using CDC's Pertussis Death Worksheet:  
[http://www.dhhr.wv.gov/oeps/disease/IBD\\_VPD/VPD/Documents/Pertussis%20Death%20Worksheet.pdf](http://www.dhhr.wv.gov/oeps/disease/IBD_VPD/VPD/Documents/Pertussis%20Death%20Worksheet.pdf)

### 6. Trace Contacts

#### A) Definition of a close contact:

- 1) Anyone who has had direct face-to-face contact for a period (not defined) with a case-patient who is symptomatic during the catarrhal and early paroxysmal stages of infection. This includes ALL residents of the same household; daycare and baby-sitting contacts; and close friends, regardless of immunization status. The disease is spread by direct contact with respiratory secretions or face-to-face exposure.
- 2) Shared confined space in close proximity for a prolonged period of time, such as  $\geq 1$  hours, with a symptomatic case-patient: or
- 3) Direct contact with respiratory, oral, or nasal secretions from a symptomatic case-patient (e.g., an explosive cough or sneeze in the face, sharing food, sharing eating

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utensils during a meal, kissing, mouth-to mouth resuscitation, or performing a full medical examination including examination of the nose and throat).

### **B) Management of Contacts**

- 1) Asymptomatic contacts who are within 3 weeks (21 days) of their last exposure to an infectious case-patient:
  - a) Prophylax with a regimen in Table 1.
  - b) Bring immunizations up-to-date (Table 2)
- 2) Asymptomatic contacts who were last exposed more than 3 weeks (21 days) Previously:
  - a) Chemoprophylaxis has limited value but should be considered in households that have high risk persons (infants, pregnant women, or persons who have contact with infants).
  - b) Bring immunizations up-to-date (Table 2).
- 3) Symptomatic contacts:
  - a) Evaluate case status,
  - b) Obtain culture and PCR, and then
  - c) Treat with a regimen in Table 1.
  - d) Bring immunizations up-to-date (Table 2)
  - e) Report as a case in WVEDSS if they meet the case definition

Your regional epidemiologist, the Division of Infectious Disease Epidemiology (800-423-1271) and Office of Laboratory Services (OLS, phone - 304-558-3530) are available to assist with contact tracing, testing, prophylaxis or treatment and immunization.

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**Table 1. Recommended Antimicrobial Therapy and Postexposure Prophylaxis for Pertussis in Infants, Children, Adolescents, and Adults**

Age	Recommended Drugs			Alternative
	Azithromycin <sup>1</sup>	Erythromycin	Clarithromycin	TMP-SMX <sup>2,3</sup>
< 1 mo	10 mg/kg per day as a single dose for 5 days	40 mg/kg per day in 4 divided doses for 14 days	Not recommended	Contraindicated at < 2 mo of age
1-5 mo	See above	See above	15 mg/kg per day in 2 divided doses for 7 days	≥ 2 mo of age: TMP 8 mg/kg/day; SMX, 40 mg/kg/day in 2 divided doses for 14 days
≥ 6 mo and children	10 mg/kg as a single dose on day 1 (maximum 500 mg); then 5 mg/kg/ day as a single dose on days 2-5 (maximum 250 mg/day)	See above (maximum 2 g/day)	See above (maximum 1 g/day)	See above
Adolescents and Adults	500 mg as a single dose on day 1, then 250 mg as a single dose on days 2-5	2 g / day in 4 divided doses for 14 days	1 g/day in 2 divided doses for 7 days	TMP, 200 mg/day; SMX, 1600 mg/day in 2 divided doses for 14 days

<sup>1</sup>Azithromycin is the preferred agent for infants because of risk of idiopathic hypertrophic pyloric stenosis associated with erythromycin

<sup>2</sup>TMP = trimethoprim and SMX = sulfamethoxazole

<sup>3</sup>TMP-SMX is contraindicated in pregnant women

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**Table 2: Immunization of persons exposed to pertussis**

<b>Situation</b>	<b>Recommended Action</b>
Immunizations up-to-date for age	Reinforce importance of staying up-to-date
Age < 7 years and unimmunized or underimmunized	Initiate or continue pertussis immunization according to the recommended schedule
Age < 7 years and third dose was 6 months or more before exposure	Administer a fourth dose of DTaP now.
Age < 7 years and fourth dose was 3 years or more before exposure	Administer a fifth dose of DTaP now.
Age 11 or 12 years and childhood DTP/DTaP vaccine series completed <sup>6</sup>	Tdap indicated as single booster dose. Tdap is preferred over Td as adolescents are susceptible to pertussis due to waning immunity, though Td may be indicated rather than Tdap in special situations <sup>4</sup> .
Adolescents who did <u>not</u> receive Tdap at age 11 or 12 years <sup>6</sup>	Should receive single dose of Tdap in place of single Td booster dose. Tdap can be administered regardless of interval since the last tetanus or diphtheria containing vaccine.
Age 7 to 18 years who have <sup>6</sup> <ul style="list-style-type: none"> <li>received tetanus and diphtheria containing vaccines (DT or Td) instead of DTP/DTaP for some or all doses of the childhood series</li> <li>fewer than 5 doses of DTP/DTaP or 4 doses if the 4<sup>th</sup> dose was given at age 4 years or older</li> <li>never been vaccinated against tetanus, diphtheria, or pertussis</li> </ul>	<p>Single dose Tdap, followed by a dose of Td four weeks after the 1<sup>st</sup> dose and a 2<sup>nd</sup> dose of Td 6-12 months later. If not administered as the 1<sup>st</sup> dose, Tdap can be substituted for any of the other Td doses in the series.</p> <p>Tdap is preferred over Td as adolescents are susceptible to pertussis due to waning immunity, though Td may be indicated rather than Tdap in special situations<sup>4</sup>.</p>
Pregnancy in an adolescent age 11 to 18	Pregnancy is not a contraindication to Tdap. Follow the adolescent guidelines (above).
Adults age 19 – 64 years	Administer Tdap, if not already documented, regardless of interval since last tetanus- or diphtheria-toxoid containing vaccine <sup>7</sup>

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### **Exposures in Child Care**

Exposed children especially incompletely immunized children and care providers should be observed for respiratory tract symptoms for 21 days after contact with an infectious case-patient has been terminated. Immunization and chemoprophylaxis (see Tables 1 and 2) should be administered as recommended for household and other close contacts. Symptomatic children with suspected or confirmed pertussis should be excluded from child care pending evaluation and completion of 5 days of recommended antibiotic therapy. Untreated adults should be excluded until 21 days have elapsed from cough onset.

### **Disease Prevention Objective**

Prevent cases of disease by encouraging full immunization of children, adolescents and adults as per ACIP recommendations.

### **Disease Control Objectives**

Prevent secondary cases by:

1. Assuring the case is placed in droplet isolation until five days after the start of a full course of antimicrobial treatment or until 21 days after cough onset in those who do not receive antimicrobial therapy.
2. Early identification and prophylaxis of close contacts to cases.

### **Disease Surveillance Objectives**

- To determine the incidence of pertussis in West Virginia;
- To determine whether cases are due to failure to vaccinate or vaccine failure;
- To identify sources and sites of transmission;
- To identify probable cases (symptomatic individuals epidemiologically-linked to a confirmed case);
- To monitor the effectiveness of outbreak control strategies.

### **Public Health Significance**

After the introduction of routine vaccination against pertussis in the late 1940s, the number of pertussis reports declined from approximately 200,000 annual cases in the prevaccine era to a low of 1,010 cases reported in 1976. Since then, a steady increase in the number of reported cases has occurred; reports of cases among adults and adolescents have increased disproportionately. In 2005, 25,616 cases of pertussis were reported to the CDC. Adults aged 19-64 years accounted for 27% of

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the total cases. The increase in nationally reported cases of pertussis since then might reflect a true increase in the burden of pertussis among adults or the increasing availability and use of PCR to confirm cases and increasing clinician awareness and reporting of pertussis.

Vaccination of susceptible persons is the most important preventive strategy against pertussis. Universal childhood pertussis vaccine recommendations have been implemented since the mid-1940s. For protection against pertussis during childhood, the Advisory Committee on Immunization Practices (ACIP) recommends 5 doses of diphtheria and tetanus toxoid and acellular pertussis (DTaP) vaccine at ages 2,4,6,15-18 months, and 4-6 years. Childhood vaccination coverage for pertussis vaccines has been at an all-time high. However, neither vaccination nor natural disease confers complete or lifelong protective immunity against pertussis or reinfection. Immunity wanes after 5-10 years from the last pertussis vaccine dose. Older children, adolescents, and adults can become susceptible to pertussis after a complete course of vaccination during childhood.

In 2005, two Tetanus Toxoid and Reduced Diphtheria Toxoid and Acellular Pertussis vaccines adsorbed (Tdap) formulated for adolescents and adult were licensed in the United States (BOOSTRIX, GlaxoSmithKline Biologicals, Rixensart, Belgium and ADACEL, Sanofi Pasteur, Toronto, Ontario, Canada). ACIP voted to recommend a single dose of Tdap for adolescents aged 11-18 years in June 2005 and adults aged 19-64 years in October 2005. Updated recommendations released in 2011 indicate a single dose of Tdap for children 7-10 years of age who have incomplete or unknown pertussis vaccine history, a single dose for adults of any age (including those 65 and older) who have not previously received Tdap and are healthcare workers or anticipate close contact with an infant < 12 months of age. This dose of Tdap can be given in place of Td, or given at any time, regardless of the interval since last tetanus- or diphtheria-toxoid containing vaccine when Tdap is indicated.<sup>8</sup> Surveillance data enables monitoring of the impact of immunization programs, as well as identifies high risk areas, age group for targeted immunization, and outbreaks.

Pertussis, or whooping cough, is an acute infectious cough illness caused by the bacterium *Bordetella pertussis*, a fastidious gram-negative coccobacillus. Outbreaks of pertussis were first described in the 16<sup>th</sup> century, and the organism was first isolated in 1906. In the 20th century pertussis has been one of the most common childhood diseases and a major cause of childhood mortality in the United States. Prior to the availability of pertussis vaccine in the 1940s, over 200,000 cases of pertussis were reported annually.

Pertussis is transmitted from person to person through large respiratory droplets generated by coughing or sneezing. Neither infection nor immunization provides lifelong immunity. Lack of natural booster events and waning immunity since childhood immunization are responsible for the growing number of cases of pertussis in people older than 10 years of age. Pertussis occurs endemically with 3-5 year cycles of increased disease. The usual incubation period for pertussis is 7-10 days (range 5-21 days) and patients with pertussis are most infectious during the catarrhal and early paroxysmal phases of illness and can remain infectious for  $\geq 6$  weeks. The infectious period is shorter, usually < 21 days, among older children and adults with previous vaccination or infection. Older siblings

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(including adolescents) and adults may have mild or atypical unrecognized disease but are important sources of pertussis for infants and young children. Infected individuals are most contagious during the catarrhal stage and the first 3 weeks after cough onset. Factors affecting the length of communicability include age, immunization status or previous episode of pertussis, and appropriate antimicrobial therapy. For example, a young unimmunized and untreated infant may be infectious for 6 or more weeks after cough onset; an untreated immunized adolescent may be infectious for 2 weeks or more after cough onset. Nasopharyngeal cultures usually test negative for *B. pertussis* within 5 days after initiating macrolide therapy.

### Clinical Description

Whooping cough usually starts with cold or flu-like symptoms, such as runny nose, sneezing, fever and a mild cough. These symptoms can last up to two weeks and are followed by increasingly severe coughing spells. Fever, if present, is usually mild. The clinical course is divided into three stages:

**Catarrhal Stage:** Characterized by insidious onset of coryza (runny nose), sneezing, low grade fever, and a mild, occasional cough, similar to the common cold. The cough gradually becomes more severe, and after 1-2 weeks, the second or paroxysmal stage, begins. Patients with pertussis are most infectious from the beginning of the catarrhal stage through the 3rd week after the onset of paroxysms.

**Paroxysmal Stage:** Characterized by bursts, or paroxysms of numerous, rapid coughs, apparently due to difficulty expelling thick mucous from tracheobronchial tree. At the end of the paroxysm, a long inspiratory effort is usually accompanied by a characteristic high pitched whoop. During such an attack, the patient may become cyanotic (turn blue). Vomiting and exhaustion commonly follow the episode. The patient usually appears normal between attacks. The paroxysms can occur more frequently at night.

**Convalescent Stage:** Characterized by gradual recovery. The cough becomes less paroxysmal and disappears over 2-3 weeks. However paroxysms often recur with subsequent viral respiratory infections for many months after the onset of pertussis. Older persons (i.e., adolescents and adults), and those partially protected by the vaccine, may become infected with *B. pertussis*, but usually have milder disease. Pertussis in these persons may present as a persistent (<7 days) cough, and may be indistinguishable from other upper respiratory infections.

### Etiologic Agent

*Bordetella pertussis* is a fastidious, gram-negative, pleomorphic bacillus.

### Reservoir

Pertussis is a human disease. No animal or insect source or vector is known to exist.

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### **Mode of Transmission**

Pertussis is transmitted person-to-person by direct or droplet contact with nasopharyngeal secretions of an infected person.

### **Incubation Period**

The incubation period of pertussis is usually 7-10 days, with a range of 5-21 days and has been reported to be as long as 6 weeks.

### **Infectious Period**

An infected person can transmit the disease from early catarrhal stage and at the beginning of the paroxysmal cough stage (first 2 weeks) to 3 weeks after cough onset. If treated with appropriate antibiotics, the person is considered infectious through the 5<sup>th</sup> day of treatment.

### **Outbreak recognition**

Outbreak is defined as two or more cases involving two or more households clusters in time (e.g., cases occurring within 42 days of each other) and space (e.g. in one building) where transmission is suspected to have occurred (e.g. a school). One or more cases in an outbreak should be confirmed by positive culture results (CDC).

### **2014 Case Definition**

#### ***Clinical Criteria***

In the absence of a more likely diagnosis, a cough illness lasting  $\geq 2$  weeks, with at least one of the following signs or symptoms:

- Paroxysms of coughing; **OR**
- Inspiratory whoop; **OR**
- Post-tussive vomiting; **OR**
- Apnea (with or without cyanosis) (FOR INFANTS AGED <1 YEAR ONLY)

#### ***Laboratory Criteria for Diagnosis***

- Isolation of *B. pertussis* from a clinical specimen
- Positive PCR for pertussis

#### ***Epidemiologic Linkage***

Contact with a laboratory-confirmed case of pertussis\*.

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### **Case Classification**

#### ***Probable***

- In the absence of a more likely diagnosis, a cough illness lasting  $\geq 2$  weeks, with
  - At least one of the following signs or symptoms:
    - Paroxysms of coughing; or inspiratory "whoop"; or
    - Post-tussive vomiting; or
    - Apnea (with or without cyanosis) (FOR INFANTS AGED <1 YEAR ONLY)

#### **And**

- Absence of laboratory confirmation;

#### **And**

- No epidemiologic linkage to a laboratory-confirmed case of pertussis.

#### **OR, FOR INFANTS AGED <1 YEAR ONLY:**

- Acute cough illness of any duration, with
- At least one of the following signs or symptoms:
  - Paroxysms of coughing; or
  - Inspiratory "whoop"; or
  - Post-tussive vomiting; or
  - Apnea (with or without cyanosis)

#### **And**

- Polymerase chain reaction (PCR) positive for pertussis.

#### **OR, FOR INFANTS AGED <1 YEAR ONLY:**

- Acute cough illness of any duration, with
- At least one of the following signs or symptoms:
  - Paroxysms of coughing; or
  - Inspiratory "whoop"; or
  - Post-tussive vomiting; or
  - Apnea (with or without cyanosis)

#### **And**

- Contact with a laboratory-confirmed case of pertussis.

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### ***Confirmed***

- Acute cough illness of any duration, with isolation of *B. pertussis* from a clinical specimen.

### **OR**

- Cough illness lasting  $\geq 2$  weeks, with
- At least one of the following signs or symptoms:
  - Paroxysms of coughing; or
  - inspiratory "whoop"; or
  - Post-tussive vomiting; or
  - Apnea (with or without cyanosis) (FOR INFANTS AGED  $<1$  YEAR ONLY)

### **And**

- Polymerase chain reaction (PCR) positive for pertussis.

### **OR**

- Cough illness lasting  $\geq 2$  weeks, with
- At least one of the following signs or symptoms:
  - Paroxysms of coughing; or
  - inspiratory "whoop"; or
  - Post-tussive vomiting; or
  - Apnea (with or without cyanosis) (FOR INFANTS AGED  $<1$  YEAR ONLY)

### **And**

- Contact with a laboratory-confirmed case of pertussis\*.

### **Case Classification Comments**

\*Note: An illness meeting the clinical case definition should be classified as "probable" rather than "confirmed" if it occurs in a patient who has contact with an infant aged  $<1$  year who is Polymerase Chain Reacton (PCR) positive for pertussis and has  $\geq 1$  sign or symptom and cough duration  $<14$  days (classified as "probable" case).

### **Comment**

The clinical case definition above is appropriate for endemic or sporadic cases. In outbreak settings, a case may be defined as a cough illness lasting at least 2 weeks (as reported by a health professional). *Both probable and confirmed cases should be reported to DIDE.*

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### **Laboratory Diagnosis of Pertussis**

The culture is the gold standard for diagnosis of *Bordetella pertussis*. All suspected cases of pertussis should have a nasopharyngeal aspirate or swab obtained for culture from the posterior nasopharynx.

1. Numerous studies have demonstrated the potential for Polymerase Chain Reaction (PCR) assays to detect *Bordetella* cells with greater sensitivity and more rapidly than culture. However, no specific technique for PCR is universally accepted or validated among laboratories and the correlation between PCR results and the disease is not well established. Culture is the gold standard for diagnosis. The West Virginia Office of Laboratory Services (OLS) provides culture free of charge. To consult on laboratory diagnosis by culture please contact OLS at 304-558-3530 or visit <http://www.wvdhhr.org/labservices/labs/micro/index.cfm>. PCR has the advantage of rapid turn around time; however the Centers for Disease Control and Prevention recommend culture confirmation whenever PCR is performed. Serologic tests are neither diagnostic nor recommended. The Office of Laboratory Services runs PCR automatically when culture is requested. WVDHHR recommends testing through OLS or a commercial lab that offers culture confirmation of PCR results.

The direct immunofluorescence assay (DFA) of nasopharyngeal secretions is not a reliable criterion for laboratory confirmation of diagnosis. DFA has variable sensitivity and low specificity and cross reactions with normal nasopharyngeal flora account for false-positive results in up to 85% of tests leading to substantial unnecessary public health intervention.

### **Who SHOULD BE tested for pertussis?**

- a) All persons with signs and symptoms of pertussis
- b) Symptomatic close contact(s) of a confirmed or probable pertussis cases

### **Who SHOULD NOT be tested for pertussis?**

- a) Asymptomatic close contact(s)
- b) Individuals who are NOT close contacts and do have symptoms of pertussis
- c) The worried well

### **Surveillance Indicators**

- a) Proportion of cases with laboratory confirmation.
- b) Proportion of investigations with complete demographic information.
- c) Proportion of probable and confirmed cases reported with complete vaccination history recorded.
- d) Proportion of cases with contacts identified
- e) Mean/median contacts per case.

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### **References**

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